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THE BRITISH TAENIOPTERYGIDAE (PLECOPTERA).

By H. B. N. Hynes.

(*Department of Zoology, University of Liverpool*).

Manuscript received 4th January, 1957.

(Read 1st May, 1957).

With 6 Text-figures.

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I. Introduction and Acknowledgments.

When my key to the nymphs of Plecoptera was published (Hynes, 1941) the nymphs of only two of the four British species of the Taeniopterygidae were known, namely, *Taeniopteryx nebulosa* (L.) and *Brachyptera risi* (Morton). *B. putata* (Newman) had not been recorded since Morton's paper (1911) on the species, and the identity of the British species of *Rhabdiopteryx* was in doubt (Hynes, 1940) as only a single female was known. Later Kimmins (1943) received a further female and two males of this insect and described it as a new species, *R. anglica*. This, and the collection of fresh material of other species by the late Mr. H. Whitehead and myself has made it possible to work out means of identifying the nymphs of all four British species of the family, and to produce a new key to the adults. It has been known for some time that the keys of Hynes (1940) and Kimmins (1950) were unsatisfactory in certain respects, but it has not, until now, been possible to improve on them because of the dearth of specimens of the above two species.

Apart from these rather practical considerations the family is of particular interest in that these two species are unknown outside Britain, and British specimens of *T. nebulosa* have been shown to differ from continental ones.

I wish here to acknowledge with grateful thanks the help I have received from many people. The Research Grants Committee of the University of Liverpool financed my collecting trips. Dr. J. Aubert, Dr. Per Brinck, Dr. J. Illies, and Mag. Sc. E. W. Kaiser have supplied me with specimens from the Continent; Mr. D. E. Kimmins and Mr. A. R. Waterston have given me information about specimens in the British and Royal Scottish Museums, and Mr. G. Garth accompanied me on my second long journey to Strath Oykell and found the one nymph of *B. putata* after we had both searched for many hours. Finally, the late Mr. Whitehead, by his enthusiasm and perseverance, enabled me to find *R. anglica*.

II. The Imagines.

Taeniopteryx nebulosa (L.) **britannica** ssp. n.

Aubert (1950) points out that British specimens of this species differ from continental specimens in the tendency of the males to have short wings, both sexes having a faint bar across the wing, and in the presence of well-developed median humps on the front and rear of the nymphal pronotum. Continental specimens are all fully winged, without a bar, and the pronotal humps of the nymphs are small. He did not, however, consider that these differences were sufficient to warrant the naming of a subspecies. Morton (1911) had already pointed out that British males tended to have short wings, although fully winged specimens were known.

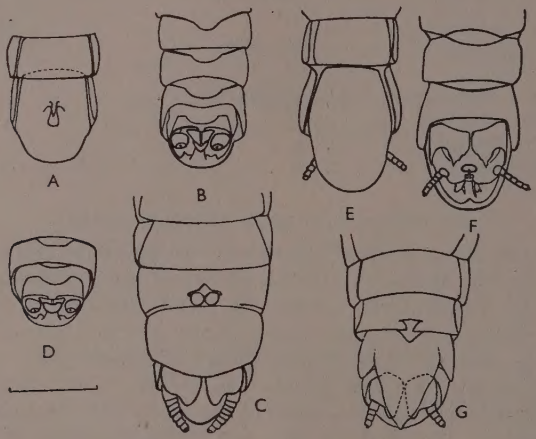

Fig. 1.—*A*, ventral view, *B*, dorsal view of tip of abdomen of male *Taeniopteryx nebulosa* from Scotland. *C*, ventral view of tip of abdomen of female *T. nebulosa* from Scotland. *D*, dorsal view of tip of abdomen of male *T. nebulosa* from Denmark. *E*, ventral view, *F*, dorsal view of tip of abdomen of male *Rhabdiopteryx anglica*. *G*, ventral view of tip of abdomen of female *R. anglica*. (Line represents 1 mm.).

Further study has, however, revealed another difference, and this I think warrants recognition of the British race as distinct, for it applies to all males. In his key to the males Aubert separates *T. nebulosa* from *T. hubaulti* (Aubert) and *T. schoenemundi* (Mertens) on the fact that its supra-anal lobe (epiproct) is wider than the cerci. In all British specimens which I have seen, from England, Scotland and Wales, the epiproct is distinctly narrower than the cerci, and it is also so figured by Morton. Only in this respect, however, do British specimens resemble the other two species. Figures 1*B* and *D* illustrate this difference between British and continental males. I propose, therefore, that British specimens be called subspecies *britannica* characterised as follows :

Nymph with pronounced median humps on the front and rear of the pronotum (fig. 4*C*) ; male with a tendency to short wings, which sometimes extend only to tip of

abdomen ; apex of male epiproct narrower than cerci ; wings in both sexes usually with a faint crescentic transverse bar in region of anastomosis.

The last character is more obvious in the female than in the male, where it is often very faint, and it is absent from teneral or old fluid-preserved specimens. The pronota of nymphs 3 mm. long show the humps quite clearly, and these are absent from similar small Danish specimens.

The subspecies occurs throughout the British mainland ; the species has not been recorded from Ireland.

Rhabdiopteryx anglica Kimmins.

Kimmins (1943) gives an excellent description of this species, which is known from only four localities in Yorkshire, Pickering Beck, Jugger Beck in Harwood Dale, River Nidd at Knaresborough (several specimens in the Huddersfield Museum, collected 1914) and River Rye at Helmsley (collected by the late Mr. H. Whitehead and myself), and from one locality in Radnorshire, Clywedog Brook, Cross Gates (female, 20.v.1956, collected by Mr. R. J. Spittle). It appears no longer to occur at Knaresborough, but was abundant at Helmsley in 1955.

The River Rye is there about 15 m. wide with riffles about 30 cm. deep between deeper pools, but it tends to dry right out in some years as it flows over limestone. The bed is of rough stones and gravel with some *Fontinalis* and *Hypnum*. The river contains trout, grayling, bullhead and minnows and a typical limestone river invertebrate fauna, including 14 other species of Plecoptera, and five of Ephemeroptera. It would seem, therefore, that the limited distribution of this species is not likely to be explained on purely ecological grounds.

Kimmins points out that, though differing considerably from *R. neglecta* (Albarda), widespread in western Europe (Illies, 1955), and the alpine *R. alpina* Kühtreiber, this species is more closely allied to *R. acuminata* Klapálek (1905), which is known only from the type specimen, presumably in Klapálek's collection in Prague Museum. Dr. Brinck informs me that he has been unsuccessful in attempts to borrow it for examination. The specimen came from Finland and Klapálek records it from Helsinki, but this probably refers to its museum of origin rather than its place of capture, as earlier in the text he states that the label read "*Nemoura nebulosa* L., J. F. Zetterst. (Wanda)".

In fact, there are some notable differences between *R. anglica* and *R. acuminata* as figured by Klapálek. His specimen had two subcubital cross-veins, whereas *R. anglica* usually has one, although specimens with two or none occur. *R. acuminata* has shorter, blunter points to the hind margins of the tenth tergite, the cerci are very short and appear to be single segments. The shape of the pointed subgenital plates of the two species are very similar. I feel, however, that it is very probable that these differences in the male genitalia are artefacts, and that the two species are even more closely related than would appear. Klapálek was undoubtedly working with a dried specimen. The whole epiproct is absent from his figure, which indicates that it had been pulled inwards and downwards by shrinkage. This would lower the tips of the tenth tergum and so foreshorten the points in dorsal view. Also, no other species of the genus has single segmented male cerci : this applies not only to

the western European species, but to *R. quadrata* Koponen (1949) from the Jenissei River in Siberia. It seems very probable, therefore, that the cerci of *R. acuminata* had been broken, possibly after drying. It may well be, therefore, that *R. anglica* is actually synonymous with *R. acuminata*, or merely a British subspecies, but this can only be decided when further material is available from Finland.

Kimmins (1950) in his key to the Taeniopterygidae separates *T. nebulosa* and *R. anglica* on the presence in the latter of one cubital cross-vein. Unfortunately, this character is unreliable, because specimens occur in which two or none at all are present. Accordingly other key characters have been proposed below.

Brachyptera putata (Newman).

This species has from early times been a source of confusion, and was put into synonymy with *B. trifasciata* (Pictet). Morton (1911) showed, however, that it was quite distinct from the latter; nevertheless the idea of the synonymy has persisted (Claassen, 1940), and Aubert (1946) states that it replaces *trifasciata* in England. In fact, the species does not occur in England, all the well authenticated records being Scottish. Morton records it from several places on the River Clyde (where recent searches have revealed no trace) and from Perthshire, where I found one female at Kinloch Rannoch (but no breeding site) and I discovered a population also in Strath Oykell, Sutherland, below Altasmor where it was fairly common. The river here is wide and lake-like with a muddy bed partly covered by *Littorella*. The extreme edge is stony in places, but fringed with *Carex* at others. A few miles up-stream where the river is swift and stony no trace of the species was found. The adults were found under stones and amongst grass and sedge on the shore, and there were many cast skins on the stones. The only nymph obtained was also found on the shore, and very intensive search of the river bed produced no others, possibly because both my visits were too late in the year (28th March, 1955, and 10th and 11th March, 1956). Other stoneflies whose nymphs were common there were *T. nebulosa*, *Nemoura cinerea* (Retzius) and *Nemurella picteti* Klapálek, and a few specimens of *N. avicularis* Morton and *Leuctra hippopus* Kempny were found. Nymphs of the mayflies *Leptophlebia marginata* (L.), *Centroptilum luteolum* (Müller) and *Procloeon rufulum* (Müller) were common, as were oligochaetes and Chironomid larvae in the mud. This was, therefore, quite a different type of habitat from that in which *B. risi* is normally found (Hynes, 1941).

I have compared this species carefully with its continental relatives *B. trifasciata* Pictet, *B. monilicornis* Pictet (= *B. kempnyi* Klapálek (Aubert, 1947)) and *B. braueri* Klapálek, which together with *B. tristis* Klapálek constitute the group *trifasciata* (Aubert, 1946), and with *B. seticornis* Klapálek and *B. risi* Morton, which together with several species allied to *B. risi* constitute the group *risi*. I find that *B. putata* shares certain characters with both these species groups, having the moniliform antennae of the *trifasciata* group, but the membranous, globular basal segment of the male cerci of the *risi* group. If, therefore, it is wished to retain these two species groups, which are certainly a taxonomic convenience, they should be distinguished entirely on the antennae.

Morton (1911) also compared *B. putata* with *B. trifasciata*, *B. braueri*, *B. monilicornis* and *B. risi* and concluded that it was different from them all, particularly in the shape of the tip of the epiproct, but he had two pairs of specimens from the eastern Carpathians which closely resembled *B. putata*. These were not described and no species similar to *B. putata* has since been described.

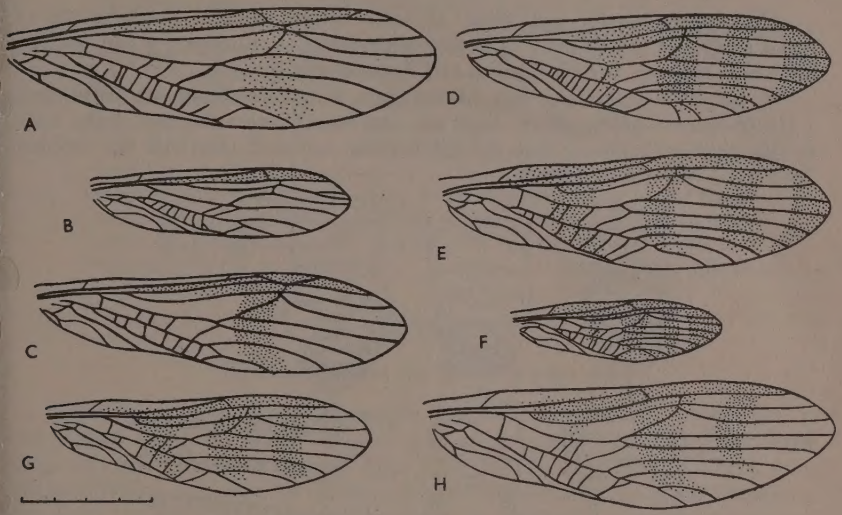

FIG. 2.—Fore wings of *A*, female and *B*, male *Taeniopteryx nebulosa* from Scotland. *C*, male *Rhabdiopteryx anglica*, *D*, male *Brachyptera monilicornis* from Germany. *E*, female and *F*, male *B. putata*. *G*, male and *H*, female *B. risi* from the Lake District. (Scale in mm.).

Unlike Morton, I have been struck by the similarity between *B. putata* and *B. monilicornis*. The general appearance of the two species is very similar; both have moniliform antennae in both sexes, and both possess a similar pattern of three dark bands on the wings, which are also darkened at the tip (figs. 2*D*, *E* and *F*). The females differ in that the subgenital plate of *B. monilicornis* is a little wider and more rounded at the tip than that of *B. putata* (fig. 3*D*). The male genitalia are remarkably alike, the only notable differences being that the basal segments of the cerci are elongate and lightly chitinised in *B. monilicornis* and bladder-like in *B. putata*, and that the margin of the subgenital plate in the latter is lightly excised (figs. 3*C* and *E*). Morton shows the tips of the epiprocts as strikingly different, but I find the difference small (figs. 3*K* and *L*) and much less than that between other members of the species group. The wings are alike in both species in venation, as well as in banding, and the only difference observable is that those of male *putata* are short, extending only to the tip of the abdomen. This shortening of the wings, it may be noted, is quite different from that of *B. trifasciata*, where the fore wings are very much shorter than the hind wings.

It would seem, therefore, that *B. monilicornis* and *B. putata* are closely

related, and that Morton's specimens from the Carpathians belonged to the same species group. Both Aubert (1946) and Illies (1955) state that *B. monilicornis* is a large river species, and the same appears to apply to *putata*.

Brachyptera risi Morton.

This species occurs apparently all over Britain, and is characteristic of small swift stony streams: it is also widespread in Europe. I can find no difference between British, Danish and Swiss specimens.

In our keys separating this species from *B. putata*, Kimmins (1950) and I (1940) have used the short wings and the moniliform antennae of the male to distinguish *B. putata*, but for the females we have relied on the number

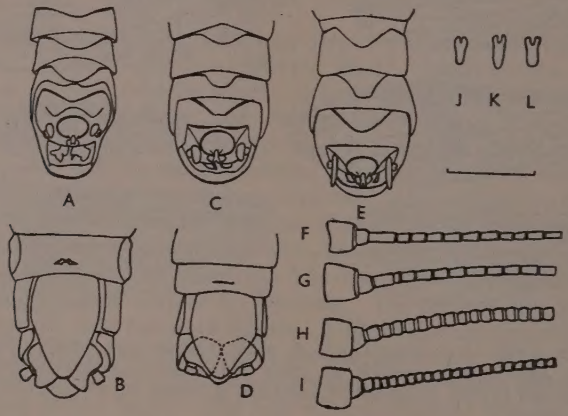

FIG. 3.—Tips of abdomens: *A*, male *Brachyptera risi* in dorsal view. *B*, female *B. risi* in ventral view. *C*, male *B. putata* in dorsal view and *D*, female *B. putata* in ventral view. *E*, male *B. monilicornis* from Germany in dorsal view. Bases of antennae: *F*, male and *G*, female *B. risi*. *H*, male and *I*, female *B. putata*. *J*, *K* and *L*, tips of male epiprocts of *B. risi*, *B. putata* and *B. monilicornis*. (Line represents 1 mm. *J*, *K* and *L* not to this scale).

of accessory veins to Cu_1 in the fore wing and the presence in *B. putata* of the darkened tip of the fore wing. These characters are not very satisfactory and the female genitalia of the two species are very similar (fig. 3*B* and *D*) so that identification is extremely difficult. The antennae of both sexes, however, provide good distinguishing characters (fig. 3*F*, *G*, *H* and *I*), and these are used in the following revised key.

Key to the Adults of British Species.

1 (4) Fore wing with 2 branches to vein Cu_1 (fig. 2*A*, *B* and *C*); only a single dark band across the wing, often indistinct.

2 (3) Each coxa with scar on inner posterior side (fig. 4*D*); fore wing with no subcubital cross-veins (fig. 2*A* and *B*); *males* often short-winged, with 1-segmented cerci (fig. 1*B*) and a ventral

vesicle on ninth sternum (fig. 1*A*); *female* subgenital plate broad and little drawn out posteriorly (fig. 1*C*)
Taeniopteryx nebulosa (L.)

3 (2) Coxae without scars; fore wing *usually* with 1 or 2 subcubital cross-veins (fig. 2*C*); *males* fully winged, with cerci of several segments (fig. 1*F*) and without a vesicle on ninth sternum (fig. 1*E*); *female* subgenital plate long and drawn out to a point (fig. 1*G*)
Rhabdiopteryx anglica Kimmins

4 (1) Fore wing with more than 2 branches to vein Cu_1 (fig. 2*E*, *F*, *G* and *H*); 3 dark bands across wing.

5 (6) Antennae moniliform (like a string of beads), basal segments being as wide as long (fig. 3*H* and *I*); apex of fore wing darkened (fig. 2*E* and *F*); *male* short-winged; *female* with 4 or more branches to Cu_1 in fore wing . . . . **Brachyptera putata** (Newman)

6 (5) Antennae filiform (parallel sided), basal segments being longer than wide (fig. 3*F* and *G*); apex of fore wing not darkened (fig. 2*G* and *H*); *male* fully winged; *female* with usually 3, sometimes 4, branches to Cu_1 in fore wing . . . . . **Brachyptera risi** (Morton)

III. The Nymphs.

Taeniopteryx nebulosa **britannica** ssp. n.

British nymphs of this species were described in an earlier paper (1941), which was, however, based only on full-grown female specimens and first instar nymphs. Smaller nymphs have been described by Brinck (1949), and Aubert (1950) has shown that this species is distinguishable from other European species by the absence of spine-like processes on abdominal terga eight and nine (fig. 4*A* and *B*).

Nymphs of subspecies *britannica* distinguished from typical form by the marked hump at front and rear of pronotum (fig. 4*C*). Characteristic pronotum visible on specimens 3 mm. long.

In British nymphs the coxal gills are present at a length of 2 mm., and the abdominal spines appear on specimens between 2 and 3 mm. long. These sizes are a little smaller than those given by Brinck for Swedish specimens.

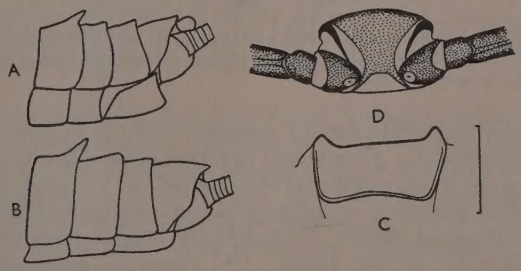

Fig. 4.—*Taeniopteryx nebulosa* from Scotland. *A* and *B*, tips of abdomens of ripe male and female nymphs. *C*, lateral view of pronotum of ripe nymph. *D*, ventral view of prothorax of adult male showing coxal scars. (Line represents 1 mm. *A* and *B* drawn from cast nymphal skins).

The sexes of small nymphs cannot be determined externally, but in large specimens the ninth sternum of the male is more drawn out than that of the female and the epiproct (supra-anal lobe) appears as a knob above the cerci (fig. 4*A* and *B*).

Rhabdiopteryx anglica.

Morphologically nymphs of this species very closely resemble those of *B. risi.* As I have previously pointed out (Hynes, 1941), the characters pro-

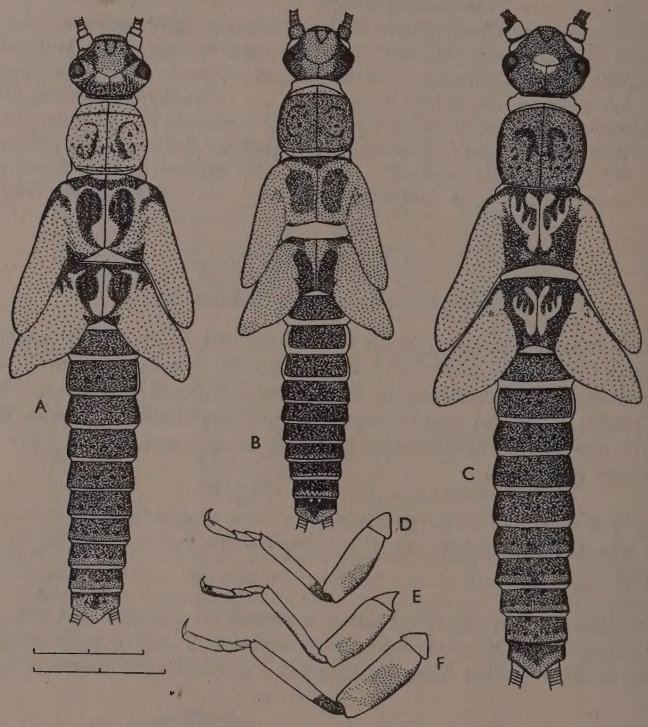

Fig. 5.—Ripe female nymphs and their fore legs. *A* and *D*, *Rhabdiopteryx anglica*. *B* and *E*, *Brachyptera risi*. *C* and *F*, *B. putata*. (Scales in mm.; the upper applies to *A–C*, and the lower to *D–F*).

posed by Kühtreiber (1934) for the separation of the nymphs of these two genera are unsatisfactory. Illies (1955) has since given a key to these nymphs, in which he uses the relative darkness of the upper and undersides of the nymph (which is equal in *Rhabdiopteryx* while *Brachyptera* is paler beneath), and the corner of the epicranial suture. Unfortunately, the nymph of *R. anglica* is considerably paler below than above. The epicranial suture does provide a usable character, but it is not a good one. In *Rhabdiopteryx* this suture forms a definite corner between the ocelli, while in *Brachyptera* this corner is more or less rounded. The distinction is, however, very subtle (fig. 5*A*, *B* and *C*).

The shapes of the sub-anal plates (paraprocts) of the male nymphs also differ (figs. 6*D*, *F* and *H*) as was pointed out by Kühtreiber, but this only applies to well-grown male nymphs.

Careful search has, however, revealed two truly nymphal characters which are shown in figure 6, and which apply to British material and the four continental species of which I have specimens (*R. neglecta*, *R. alpina*, *B. trifasciata* and *B. monilicornis*). They also apply to young nymphs (3 mm.) of *B. risi*, and so are probably sound for practical purposes.

In *Brachyptera* the abdominal terga bear small upstanding bristles, which are easily seen in profile (fig. 6*B* and *C*). In *Rhabdiopteryx* these bristles are represented by fine clothing hairs which lie flat and are not visible in profile (fig. 6*A*). In *Brachyptera* the first few basal segments of the cerci bear long hairs on the dorsal side, which are absent from *Rhabdiopteryx*.

Nymph pale yellow below, with a characteristic brown and yellow pattern above (fig. 5*A*); antennae, mouth parts and cerci pale, as also the legs, apart from a brown mark on the femur and the top of the tibia (fig. 5*D*); subgenital plates and paraprocts of full-grown male and female nymphs as shown in fig. 6*D* and *E*. Smaller males resemble the females and sexes of nymphs 6 mm. long (the smallest I possess) not distinguishable. Full-grown nymphs 8–10 mm. long. In other respects nymphs resemble those of *B. risi*.

Brachyptera putata.

I have only one nymph of this species, a fully ripe female (fig. 5*C*), and a large number of cast skins. These differ from *B. risi* only in the shape of the male epiprocts and subgenital plates and in coloration and pattern, the latter being quite visible on cast skins, and so strikingly different as to make identification simple (fig. 5).

The following points are important in specific determination :

Nymph brown and yellow and noticeably paler below; basal segments of antennae pale but darkened at top and bottom; meso- and metanotal patterns complex and readily seen, the 3 stripes on each side being characteristic (fig. 5*C*); tarsi pale and tibiae with a clearly defined area at the top (fig. 5*F*); tenth tergum without pale marks anteriorly and all terga with a transverse row of darker spots across the middle, segments one to eight or nine with 2 such spots anteriorly near the middle line, and segment ten with a median dark spot (fig. 5*C*).

Male nymph with rather shorter wings than female, but the difference not great. Subgenital plate narrower than that of *B. risi* (fig. 6*H* and *F*) and drawn out points of paraprocts much less twisted sideways than in the latter species. Subgenital plates of females of *B. risi* and *B. putata* (fig. 6*G* and *I*) show little difference.

It is suggested above that this species is very closely allied to *B. monilicornis*. The nymph of the latter, as described by Aubert (1946), closely resembles that of *B. putata*. Dr. Aubert has sent me a female nymph of the former which is indeed very similar to my nymph of *B. putata* although much paler. The meso- and metanotal patterns are very similar, as are the dark spots on the abdomen and the darkened area at the top of the tibia. The abdominal terga of *B. monilicornis* have, however, large pale spots on each side of the median line, and, according to Aubert's figure, the subgenital plate of the male nymph is much wider and more square-ended than that of *B. putata*. In this respect, but not in colour-pattern, *B. putata* more closely resembles *B. trifasciata*.

Brachyptera risi.

The nymph of this species has been described by Hynes (1941) and Aubert (1946), whose descriptions do not differ greatly. To them should be added the generic characters given above (fig. 6*B*). The following points are of importance in specific determination :

Nymphs generally dull-brownish coloured and only a little paler below ; basal segments of antennae uniformly brown ; meso- and metathoracic patterns relatively simple (fig. 5*B*) ; tarsi darkened, and tibiae, although slightly darkened posteriorly, without a clearly defined dark area at the top (fig. 5*E*) ; tenth tergum with 2 small but quite distinct pale marks on its anterior edge ; otherwise, apart from a slight paleness at the back of the few hindermost, the terga uniformly brown without a transverse row of darker spots (fig. 5*B*) ; in full-grown male nymphs the paraprocts drawn out into heavily chitinised hooks which are bent round so that their tips project laterally or even slightly forwards (fig. 6*F*).

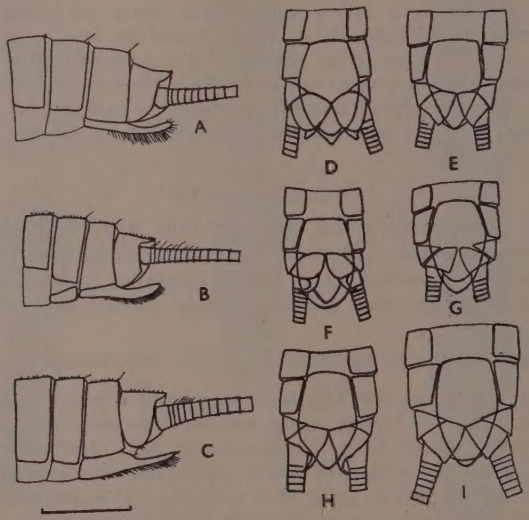

Fig. 6.—Tips of abdomens of ripe nymphs, female in lateral view, male in ventral view and female in ventral view. Structures lying above the subgenital plates are seen by transparency. *A*, *D* and *E*, *Rhabdiopteryx anglica* ; *B*, *F* and *G*, *Brachyptera risi* ; *C*, *H* and *I*, *B. putata*. (Line represents 1 mm. Drawn from cast nymphal skins : in *A–C* only those bristles are shown which can be seen in profile.)

Key to the Nymphs of British Species.

1 (2) A 3-segmented retractile filamentous gill present on the inner side of each coxa ; abdominal terga 1–7 each with a horn-like process posteriorly . . . . . **Taeniopteryx nebulosa**

2 (1) Coxae without gills ; abdominal terga without processes.

3 (4) Cerci without long hairs on the upperside ; abdominal terga without bristles, their clothing hairs lying flat, and not visible in profile (fig. 6*A*) . . . . . **Rhabdiopteryx anglica**

4 (3) Cerci with long hairs on uppersides of the basal few segments ; bristles on abdominal terga upstanding and clearly seen in profile (fig. 6*B* and *C*)

5 (6) Tarsi pale, tibiae with a clearly defined dark area at the base (fig. 5*F*) ; abdominal terga each with a transverse line of darker spots ; meso- and metanotal pattern complex (fig. 5*C*) ; anterior border of tenth tergum without pale spots . . . . . **Brachyptera putata**

6 (5) Tarsi darkened, tibiae without a clearly defined dark area at the base (fig. 5*E*) ; abdominal terga (apart from the last 2 or 3) uniformly brown ; meso- and metanotal pattern simple (fig. 5*B*) ; anterior border of tenth tergum with two small but distinct pale spots . . . . . **Brachyptera risi**

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